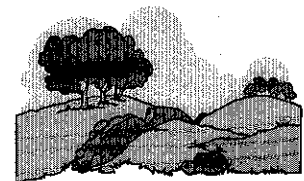


# 1. INTRODUCTION

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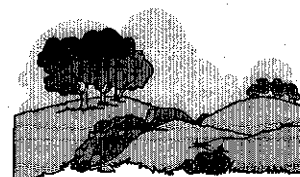
# 1. INTRODUCTION

The mission of the CALFED Bay-Delta Program (Program or CALFED) is to develop a long-term comprehensive plan that will restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system. The Program has identified six solution principles as fundamental guides for evaluating alternative solutions:

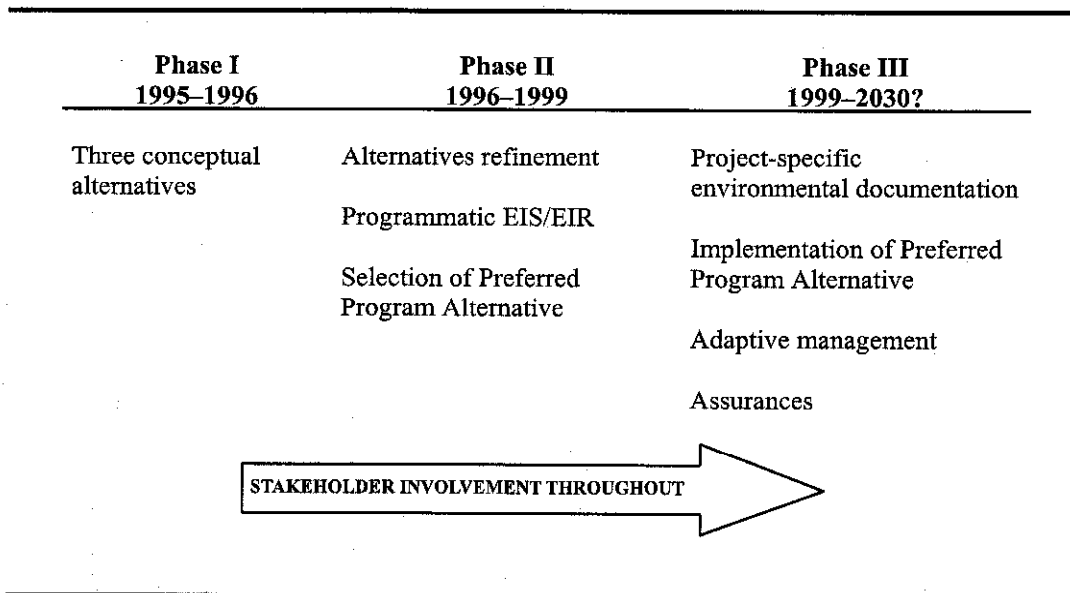
- ***Reduce conflicts in the system*** - Solutions will reduce major conflicts among beneficial uses of water.
- ***Be equitable*** - Solutions will focus on solving problems in all problem areas. Improvements for some problems will not be made without corresponding improvements for other problems.
- ***Be affordable*** - Solutions will be implementable and maintainable within the foreseeable resources of the Program and stakeholders.
- ***Be durable*** - Solutions will have political and economic staying power and will sustain the resources they were designed to protect and enhance.
- ***Be implementable*** - Solutions will have broad public acceptance and legal feasibility, and will be timely and relatively simple to implement compared with other alternatives.
- ***Result in no significant redirected impacts*** - Solutions will not solve problems in the Bay-Delta system by redirecting significant negative impacts, when viewed in their entirety, within the Bay-Delta or to other regions of California.

The Program addresses problems in four resource areas: ecosystem quality, water quality, levee system integrity, and water supply reliability. Each resource area forms a component of the Bay-Delta solution and is being developed and evaluated at a programmatic level. Therefore, problems and corrective actions are described in a general manner sufficient to make broad decisions on Program direction. The complex and comprehensive nature of a Bay-Delta solution requires a composition of many different programs, projects, and actions that will be implemented over time.

The Program is being completed in three phases (Figure 1). Phase I of the Program began in June 1995 and was completed in August 1996. During this phase, three conceptual alternatives were developed to solve Bay-Delta problems. These conceptual alternatives all include Program components to comprehen-



sively address ecosystem restoration, water quality improvements, enhanced Delta levee system integrity, and increased water supply reliability.



**Figure 1. The Three Phases of the CALFED Bay-Delta Program**

The Water Quality Program, like all components of the CALFED Bay-Delta Program (Program), is being developed and evaluated at a programmatic level. The Program is currently in what is referred to as Phase II, in which the CALFED agencies are developing a Preferred Program Alternative that will be subject to a comprehensive programmatic environmental review. This report describes both the long-term programmatic actions that are assessed in the 3/16/98 Draft Programmatic EIS/EIR, as well as certain more specific actions that may be carried out during implementation of the Program. The programmatic actions in a long-term program of this scope necessarily are described generally and without detailed site-specific information. More detailed information will be analyzed as the Program is refined in its next phase.

Implementation of Phase III is expected to begin in 2000, after the Programmatic EIS/EIR is finalized and adopted. Because of the size and complexity of the alternatives, the Program likely will be implemented over a period of 20-30 years. Program actions will be refined as implementation proceeds, initially focusing on the first 7 years (Stage 1). Subsequent site-specific proposals that involve potentially significant environmental impacts will require site-specific environmental review that tiers off the Programmatic EIS/EIR. Some actions, such as construction of treatment facilities and mine remediation, also will be

subject to permit approval from regulatory agencies. Figure 2 shows the three phases of the Water Quality Program and associated program documents.

The CALFED Bay-Delta Program's goal for water quality is to provide good water quality for environmental, agricultural, drinking water, industrial, and recreational beneficial uses. To achieve this goal, CALFED has developed and is implementing a Water Quality Program. The purpose of this report is to detail the results of Water Quality Program activities conducted during Phase II of the Program and to highlight those activities planned in Phase III.

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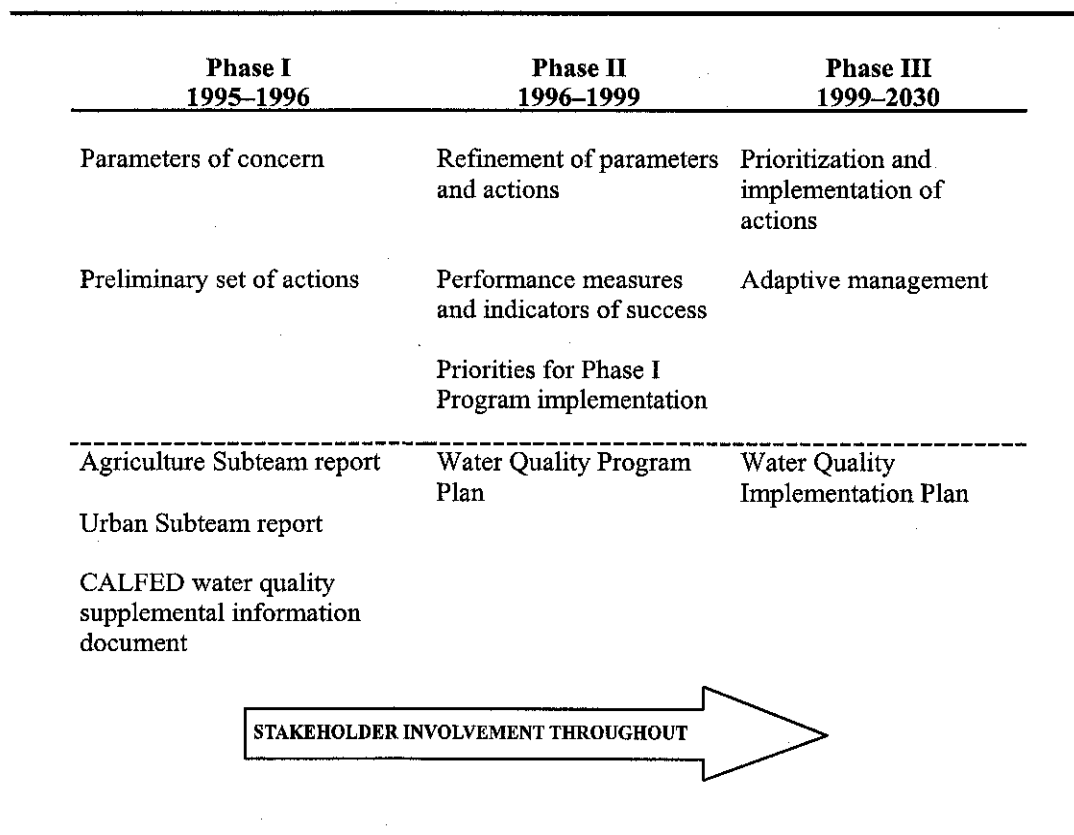
During Phase I of the Water Quality Program, parameters of concern to beneficial uses were identified, and a preliminary set of actions to address those parameters were developed. During Phase II, currently underway, the list of parameters of concern and programmatic water quality actions were refined, performance measures and indicators of success for each action were defined, monitoring and research needs were identified, initial priorities for implementation were identified, and more general plans were formulated for later implementation stages.

CALFED staff recognize that the necessity to formulate the Water Quality Program at a level of detail appropriate to a programmatic environmental document leaves many questions unanswered. Water quality problems are not spelled out in great detail, and the actions to address the problems are described in general terms. At the programmatic level of detail, the identified actions constitute a commitment to improving water quality. In many cases, this commitment cannot be fulfilled until additional study, evaluation, feasibility determination, and pilot-scale implementations are accomplished. These activities must be relegated to Phase III of the process beginning in 2000, but the intent at this stage of the program is to establish an adequate basis for project-specific work to come later.

## 1.1 PURPOSE AND NEED

The value of water is determined by its potential uses. In turn, the uses that can be made of water are determined by its quality. Water of degraded quality may not adequately support the aquatic ecosystem because it may not contain sufficient oxygen; because it may contain particles that suffocate bottom-dwelling organisms; or because it may be poisonous to aquatic organisms or to other species, including humans, that consume aquatic organisms. Salinity and other constituents in the water may render it unsuitable for many uses, such as agricultural and landscape irrigation, industrial processes, and drinking. Also, water contaminated by pathogens such as viruses, bacteria, and protozoans may

cause illnesses in animals and humans who consume the water. Clearly, therefore, if the Bay-Delta ecosystem is to be restored and conflict among beneficial users of the estuary is to be reduced, the quality of the waters must be suitable for the ecological and human uses of the resource.



**Figure 2. The Three Phases of the Water Quality Program and Associated Program Documents**

The purpose of the CALFED Water Quality Program is to improve the quality of the waters of the Sacramento-San Joaquin Delta estuary for all beneficial uses (including domestic, industrial, agricultural, recreation, and aquatic habitat). Because species dependent on the Delta are affected by upstream water quality conditions in some areas, the scope of the Water Quality Program also includes watershed actions to reduce water quality impacts on these species.

The need for action to correct water quality problems in the Delta estuary and its watersheds arises from recognition that water quality degradation negatively affects, or has the potential to negatively affect, a number of beneficial uses of the waters. The Section 303(d) list of the federal Clean Water Act (CWA) requires states to identify water bodies with impaired quality with respect to supporting

An important component of correcting the overall problems of the Delta estuary is undertaking actions to effectively reduce the toxicity of aquatic habitats and reduce constituents, such as salinity, that affect the usability of Delta water supplies.

beneficial uses. This process has resulted in a number of water bodies in the Bay-Delta estuary and its tributaries being listed as impaired. Therefore, an important component of correcting the overall problems of the Delta estuary is undertaking actions to effectively reduce the toxicity of aquatic habitats and reduce constituents, such as salinity, that affect the usability of Delta water supplies.

## 1.2 VISION

The vision for the CALFED Water Quality Program is to create water quality conditions that fully support a healthy and diverse ecosystem and the multiplicity of human uses of the waters. To realize this vision, CALFED will strive to continually improve the quality of waters of the San Francisco Bay-Delta estuary until no ecological, drinking water, or other beneficial uses of the waters are impaired by water quality problems, and to maintain this quality once achieved.

With respect to ecosystem values, the Water Quality Program envisions waters and sediments of the estuary free of toxicity to phytoplankton, zooplankton, benthic invertebrate organisms, and fish communities that inhabit the Delta estuary. Protection from accidental or intentional toxic spills would be an important feature of assurance of toxicity-free conditions. Oxygen levels in the waters of the estuary would, at all times, contain sufficient dissolved oxygen (DO) to avoid stress to aquatic organisms and to make all estuary habitats livable and attractive to aquatic species. Suspended solids loadings in the estuary would be appropriate to enable adequate recruitment of bed sediments to support a healthy and diverse community of benthic organisms, would produce water column turbidity conditions that are optimal, and would provide suspended solids in size ranges and concentrations that would avoid low DO and low oxygen exchange conditions in channel bottoms.

Waters of the estuary supplied to agricultural uses would be sufficiently low in boron to avoid toxicity to sensitive plant species, with an appropriate sodium adsorption ratio to avoid soil impermeability, and be sufficiently low in dissolved minerals (salinity) to:

- Avoid toxicity to plants,
- Promote efficient water use by enabling multiple stages of tailwater recycling,

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The vision for the CALFED Water Quality Program is to create water quality conditions that fully support a healthy and diverse ecosystem and the multiplicity of human uses of the waters.

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- Reduce salt loadings in agricultural drainage to eliminate impacts on downstream uses, and
- Attain long-term salt balance.

Delta waters used for industrial purposes would be sufficiently low in mineral concentrations to enable efficient water use and closed-loop recycling of process water; and to reduce costs from accretion of mineral deposits in piping, cooling, heating, and other industrial equipment. Industrial water supplies from the Delta also would be sufficiently low in other constituents, such as metals and nutrients, to avoid the necessity for costly pretreatment in order to render the waters suitable for incorporation into products to be ingested and other industrial uses.

Recreational uses of the waters of the Bay-Delta estuary will be enhanced by reduction of disease-causing organisms through better protection of Delta waters from animal and human contamination. Aesthetic values will be enhanced by reduction in nuisance algae blooms that are unsightly, cause odors, obstruct navigation, and foul boat bottoms.

With respect to drinking water uses, waters supplied from the Delta would be protected from releases of pathogens (e.g., viruses, bacteria, and protozoa) from sources such as recreational boating, livestock grazing, stormwater runoff, sewage spills, and wastewater discharges. Watershed protection measures also would be applied to reducing known and potential sources of turbidity, nutrients, and toxic substances that contribute to reducing the safety of drinking water supplies and the reliability of water treatment. Bromide and organic carbon concentrations would be present in drinking water supplies taken from the Delta in concentrations sufficiently low as to enable meeting current and prospective drinking water regulations. Concentrations of all constituents and variability in source water quality would be sufficiently low as to enable water utilities to provide a quality of drinking water that is the equal of any in the world with respect to safety, palatability, and overall quality. Because of its high level of source protection and competent treatment, drinking water from the Delta would never be associated with outbreaks of waterborne diseases.

Municipal water supplies from the Delta would be sufficiently low in dissolved mineral content to attain record high-efficiency water use.

- Water supplies low in salinity can support multiple recyclings, thus greatly enhancing efficiency of water use and reducing dependency on importing water supplies from the Delta.
- Low-salinity water from the Delta would increase the flexibility for meeting water needs by enabling blending with alternate supplies, such as groundwater (some of which is higher in dissolved minerals than surface

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Recreational uses of the waters of the Bay-Delta estuary will be enhanced by reduction of disease-causing organisms through better protection of Delta waters from animal and human contamination.

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waters), and with other surface water supplies of lower mineral quality. The effect of this increased flexibility would reduce dependency on importing water supplies from the Delta.

The vision for water quality also includes being able to provide the critical benefits of water quality at a cost that is affordable to Californians generally and to the individual beneficiaries of the water resources of the Delta estuary.

The CALFED vision can be realized only with the help of the involved agencies and stakeholders. Its attainment must be an evolutionary process. CALFED has chosen the term “adaptive management” to refer to the concepts that (1) much remains to be learned about the Bay-Delta estuary and about what can be done to correct its problems, and (2) decisions will need to be continuously made over the next 30 years as the program is implemented. The most important part of the water quality vision is that Continual improvement in water quality will be achieved by maintaining the Water Quality Technical Group (WQTG) as the primary vehicle through which the program is guided in the coming years. Therefore, although it is not possible to predict the exact directions of the program, maintaining close involvement of the interested parties will provide the best possible assurance that correct decisions will be made while CALFED solution principles are upheld.

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The vision for water quality also includes being able to provide the critical benefits of water quality at a cost that is affordable to Californians generally and to the individual beneficiaries of the water resources of the Delta estuary.

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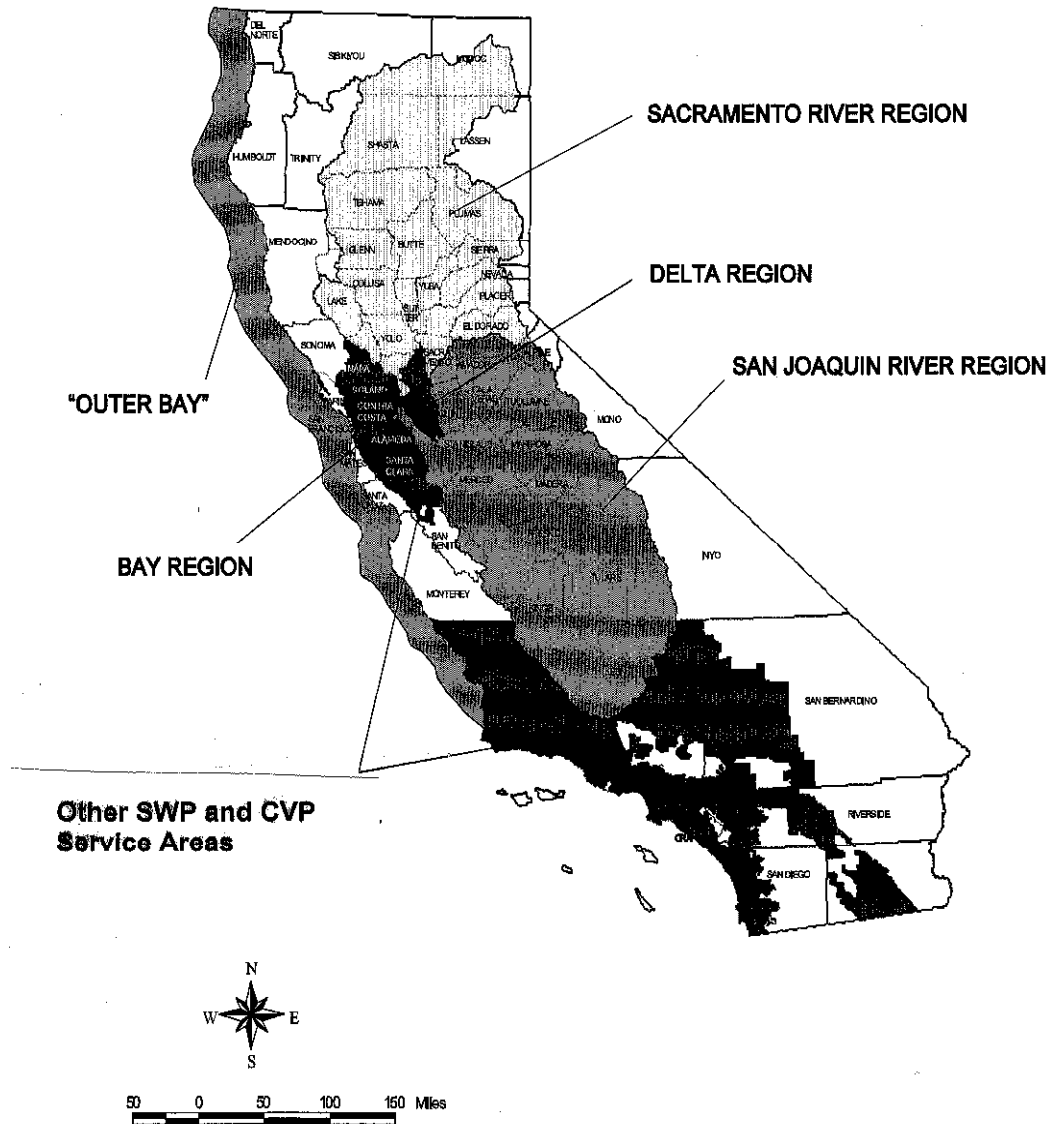
## 1.3 GEOGRAPHIC SCOPE

Consistent with the CALFED Programmatic EIS/EIR, the geographic scope of the Water Quality Program encompasses five regions:

- Delta Region,
- Bay Region,
- Sacramento River Region,
- San Joaquin River Region,
- SWP and CVP Services Areas Outside the Central Valley.

Descriptions of these regions are contained in the Glossary at the front of this document. A map showing the location of these regions follows (Figure 3).





Note: The five Program regions are described in the Glossary.

**Figure 3. Water Quality Program Plan Geographic Scope**

## 1.4 WATER QUALITY PROGRAM ACTIONS

### 1.4.1 Introduction

The Water Quality Program has developed programmatic actions to address beneficial use impairments within its geographic scope. Implementing these actions will further the program's goal of providing good quality water for environmental, agricultural, drinking water, industrial, and recreational beneficial uses of water. The water quality impact analysis of the Programmatic EIS/EIR contains a comprehensive analysis of the impacts of CALFED actions on water quality and other components of the CALFED Program.

Determining impairment to a beneficial use is almost always a difficult and complicated matter. For some beneficial uses, such as drinking water use and agricultural water use, concentrations of parameters of concern in ambient water that may affect uses are well quantified. For other beneficial uses, such as ecosystem resources, concentrations of parameters of concern in ambient water that may affect the diverse assemblages of species in the Delta Region are less well understood. As a result, the Program has relied on the technical expertise of a variety of stakeholders representing beneficial uses. These stakeholders have worked with CALFED staff to identify parameters of concern to beneficial uses, the locations of beneficial use impairments, the types of water quality actions needed to address these impairments, and the ways to assess the effectiveness of actions.

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The Program has relied on the technical expertise of a variety of stakeholders representing beneficial uses.

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### 1.4.2 Background

Stakeholders and CALFED staff have developed a list of parameters of concern to beneficial uses (Table 1). The list of parameters of concern may be updated as new information becomes available, consistent with the adaptive management policy of the CALFED Program.

Water quality problems associated with these parameters have been identified by the State in accordance with the CWA. The program used existing information from the CWA Section 303(d) list of impaired water bodies for California to identify the locations of beneficial use impairments associated with parameters of concern. The Section 303(d) list identifies water bodies with impaired beneficial uses, the parameters of concern within each water body that are thought to be responsible for the impairment, and the likely sources of the parameters of concern. Appendix B contains a list of the impaired water bodies within the

Water Quality Program's geographic focus that were identified by the State in 1998, in accordance with the CWA Section 303(d).

*Table 1. Water Quality Parameters of Concern to Beneficial Uses*

Metals and Toxic Elements	Organics/ Pesticides	Disinfection By-Product Precursors	Other
Cadmium	Carbofuran	Bromide	Ammonia
Copper	Chlordane <sup>a</sup>	TOC	DO
Mercury	Chlorpyrifos		Salinity (TDS, EC)
Selenium	DDT <sup>a</sup>		Temperature
Zinc	Diazinon		Turbidity
	PCBs <sup>a</sup>		Toxicity of unknown origin <sup>b</sup>
	Toxaphene <sup>a</sup>		Pathogens
			Nutrients <sup>c</sup>
			pH (Alkalinity)
			Chloride
			Boron
			Sodium adsorption ratio

Notes: EC = Electrical conductivity.  
TDS = Total dissolved solids.

<sup>a</sup> These compounds are no longer used in California. Toxicity from these compounds is remnant from past use.

<sup>b</sup> Toxicity of unknown origin refers to observed aquatic toxicity, the source of which is unknown.

<sup>c</sup> Nutrients includes nitrate, nitrite, ammonia, organic nitrogen, total phosphorus, and soluble reactive phosphorus.

Although the data used to develop the Section 303(d) list of impaired water bodies are subject to criticism (many people note that the data need to be updated), it is the most comprehensive information on beneficial use impairment available at this time. The program recognizes the need for a comprehensive analysis of beneficial use impairments to Delta waters and will use such additional information as it becomes available, consistent with the adaptive management policy of the CALFED Program. The implementation strategy for the Water Quality Program envisions ongoing assessments involving experts, regulatory agencies, and the public to ensure that the best possible understanding is applied to CALFED investment decisions. It is anticipated that a great deal of information on the status of water quality and beneficial use impairments throughout the study area will be compiled by the Comprehensive Monitoring, Assessment, and Research Program (CMARP).

Water quality actions to address beneficial use impairments may include a combination of research, pilot studies, and targeted activities. This approach

allows actions to be taken on known water quality problems and sources of those problems, while allowing further research of potential problems and solutions. Table 2 summarizes Water Quality Program actions by region.

Actions will be adapted over time to ensure the most effective use of resources. The individual indicators of success for each program action, shown in Appendix C, can be used to assess the effectiveness of water quality actions.

The Water Quality Program has identified narrative or numerical water quality targets for each parameter of concern (Appendix D). These targets represent desirable in-stream concentrations of parameters of concern that will be used as indicators of success to determine the effectiveness of water quality actions. However, the degree to which these targets are realized will depend on overall CALFED solutions. Targets may not be fully realized because of competing CALFED solution requirements or because attainment of a target is technically infeasible.

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Actions will be adapted over time to ensure the most effective use of resources.

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*Table 2. Summary of Water Quality Program Actions by Region*

Topic	Region				
	Delta	Bay	Sacramento River	San Joaquin River	SWP and CVP Service Areas Outside the Central Valley
Low dissolved solids	✓	✓		✓	
Drinking water	✓	✓	✓	✓	✓
Mercury	✓	✓	✓		
Pesticides	✓	✓	✓	✓	
Organochlorine pesticides	✓	✓	✓	✓	
Salinity	✓			✓	
Selenium	✓			✓	
Trace metals	✓	✓	✓	✓	
Turbidity and sedimentation	✓	✓	✓	✓	
Toxicity of unknown origin	✓	✓	✓	✓	

## 1.5 PRE-FEASIBILITY ANALYSIS

In general, water quality targets are based on the Water Quality Control Plans (WQCPs) (Basin Plans) of the Bay Area and Central Valley Regional Water Quality Control Boards, U.S. Environmental Protection Agency (EPA) ambient

water quality objectives, standard agricultural water quality objectives, and target source drinking water quality ranges as defined by technical experts. Other indicators of success may be used in conjunction with these targets on a project-specific basis to determine the effectiveness of actions toward protecting beneficial uses.

Individual programmatic actions may vary in cost, technical feasibility, and other respects that may affect the final choices for implementation. Therefore, actions will be subjected to a pre-feasibility analysis to determine which programmatic actions are most appropriate to be implemented. This analysis has begun and will continue into Phase III of the CALFED Program. Full feasibility analysis in conjunction with project-specific environmental documentation will be performed in Phase III. The process by which actions will be implemented is discussed in Section 12 "Implementation Strategy."

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Actions will be subjected to a pre-feasibility analysis to determine which programmatic actions are most appropriate to be implemented.

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## 1.6 ORGANIZATION OF THIS REPORT

This Water Quality Program Plan contains the following sections:

- "Section 1. Introduction" provides an introduction to the CALFED Program and discusses the Water Quality Program, including its purpose and need, vision, geographic scope, and an overview of Water Quality Program actions.
- "Section 2. Low Dissolved Oxygen Concentration and Oxygen-Depleting Substances" addresses sources of oxygen-depleting substances and their effects on water quality.
- "Section 3. Drinking Water" elaborates on strategies to protect and improve source water quality for drinking water production. The section discusses pollutants and their effects on drinking water.
- "Section 4. Mercury" focuses on water quality problems associated with mercury.
- "Section 5. Pesticides" identifies the toxic effects of pesticides currently in use and proposed approaches to address pesticide problems related to water quality.
- "Section 6. Organochlorine Pesticides" presents the residual effects of organochlorine pesticides on water quality.

- “Section 7. Salinity” primarily addresses the effects of salinity on agricultural and drinking water beneficial uses of water.
- “Section 8. Selenium” identifies the sources and effects of selenium related to water quality.
- “Section 9. Trace Metals” addresses the aquatic toxicity of copper, cadmium, and zinc.
- “Section 10. Turbidity and Sedimentation” identifies existing and potential turbidity and sedimentation concerns for water quality.
- “Section 11. Toxicity of Unknown Origin” discusses elements causing toxicity in the Sacramento and San Joaquin River watersheds and the Delta that have not been identified in current evaluations.
- “Section 12. Implementation Strategy”, contains an implementation strategy for the Water Quality Program..

Technical appendices follow the report.

For most sections, the discussion is separated into the following topics:

**Summary.** Provides an overview of the section.

**Problem Statement.** Presents a concise statement of the problem.

**Objective.** States the objective of the Water Quality Program for the topic being discussed.

**Problem Details.** Elaborates on the problem defined in the “Problem Statement.”

**Approach to Solution.** Identifies activities appropriate to the Water Quality Program that can minimize impacts, identifies opportunities for implementation of these activities, and determines data gaps and necessary data-gathering activities. The “Approach to Solution” section includes three subsections: “Priority Actions,” “Information Needed,” and “Existing Activities.” When information is not available or applicable, the subsection heading is not included.